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National Research Council of Canada

Client Report

B-3451.1

Final Report

Measurement of the Airborne Sound Transmission Loss of One (1) Wall Assemblies

for

NGC Testing Services
1650 Military Road
Buffalo, NY, USA
14217

05 October 2006



National Research
Council Canada

Conseil national
de recherches Canada

Canada

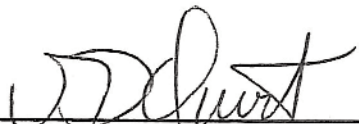
Airborne Sound Transmission Loss Measurement Performed on One Wall Assembly for NGC Testing Services

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Program: Indoor Environment

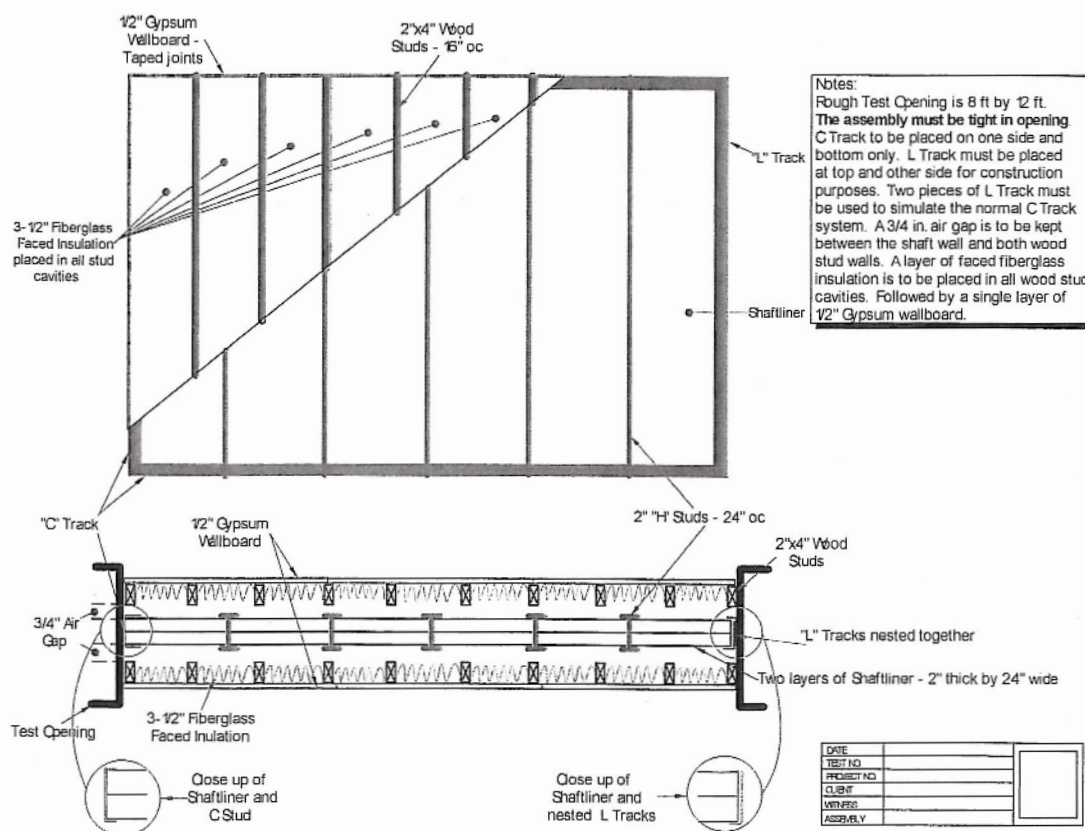
4 pages
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Client: NGC Testing Services
Specimen: Wall assembly with laminated gypsum boards
Specimen ID: B3451-1W
Construction Dates: September 12-14, 2006

Test Specimen:

The wall assembly had two layers of shaftliner between two rows of wood studs; on each exterior face was a layer of gypsum board. Two layers of shaftliner each composed of 6 panels 25 x 610 x 2440 mm, were installed vertically with H channels in between the panels. The C track was installed at the bottom and on one side of the panels and two pieces of L track installed nested together at the top and one side of the panels to simulate C track in this special installation. On both sides, an air space of 19 mm was left between the shaftliner layer and the row of 38 x 89 mm wood studs, spaced at 406 mm on center. The 89 mm thick, R12 glass fibre batts were installed in the cavities of the two row of wood studs. The 13 mm thick laminated gypsum boards identified by the client as "National Gypsum SoundBreak® Wallboard" were attached vertically to the wood studs with 41 mm long, type S drywall screws spaced at 610 on center along the edge and in the field. All the laminated gypsum board joints were caulked and covered with a metal tape.



B3451-1W: Drawing received from client of wall assembly to be built

The results reported above apply only to the specific sample submitted for measurement. No responsibility is assumed for performance of any other specimen.

Airborne sound transmission loss measurements were conducted in accordance with the requirements of ASTM E90-04, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements".

Specimen Properties

Element	Actual Thickness (mm)	Surface weight (kg/m ²)	Mass (kg)
Laminated Gypsum Board		13.27	118.4
Glass Fibre Batts		0.87	7.8
Wood Studs		5.78	51.6
Air			
Shaftliner including track		39.06	348.4
Air			
Wood Studs		5.93	52.9
Glass Fibre Batts		0.86	7.7
Laminated Gypsum Board		13.35	119.1
Total	244		705.9

Test Specimen Installation:

During the measurements, the test specimen was mounted in the IRC acoustical wall test opening which measures approximately 3.66 m x 2.44 m.

The perimeter of the specimen was sealed on both sides with caulking and then covered with a metal tape.

The area used for the calculation of the airborne sound transmission loss was 8.92 m².

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Airborne sound transmission loss measurements were conducted in accordance with the requirements of ASTM E90-04, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements".

Client: NGC Testing Services

Specimen ID: B3451-1W

Test ID: TLA-06-007

Tested: 14-Sep-06

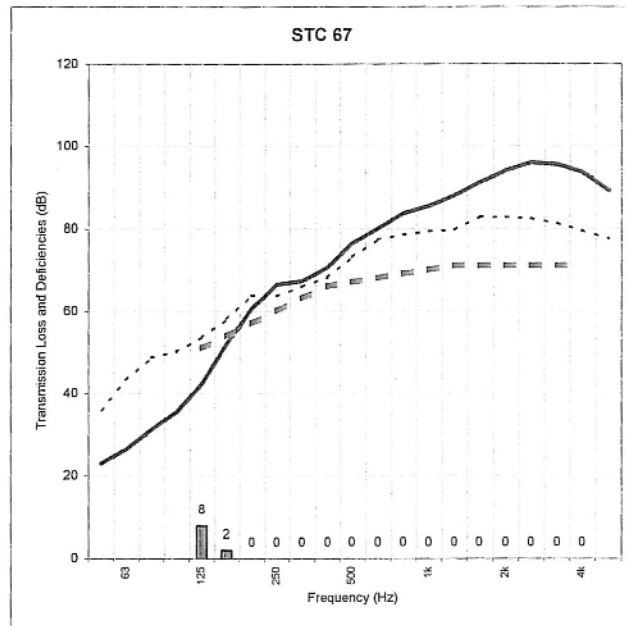
Small Room Volume: 138 m³

Large Room Volume: 250 m³

Measured Temperature and Relative Humidity During

Room	Temperature, °C		Humidity %	
	Min	Max	Min	Max
Small	21.5	21.5	60.3	60.5
Large	22.5	22.5	53.3	53.4

Frequency (Hz)	Airborne Sound Transmission Loss (dB)	95% Confidence Limits
50	23 *	
63	27	
80	31	± 5.0
100	36	± 4.7
125	43	± 2.6
160	52	± 1.7
200	61	± 0.9
250	66 c	± 0.9
315	67	± 0.9
400	71	± 0.9
500	77	± 0.7
630	80 c	± 0.5
800	84 c	± 0.5
1000	86 *	± 0.4
1250	88 *	± 0.4
1600	91 *	± 0.3
2000	94 *	± 0.3
2500	96 *	± 0.4
3150	96 *	± 0.5
4000	94 *	± 0.5
5000	89 *	± 0.5
Sound Transmission Class (STC) = 67		



In the graph:

Solid line is the measured sound transmission loss for this specimen. Dashed line is the STC contour fitted to the measured values according to ASTM E413-04. The dotted line is 10 dB below the flanking limit established for this facility. For any frequency where measured transmission loss is above the dotted line, the reported value is potentially limited by vibration transmission via laboratory surfaces, and the true value may be higher than that measured.

Bars at bottom of graph show deficiencies. At each frequency the difference between the shifted reference contour value and the measured data is calculated. Only deficiencies, that is, where the measured data are less than the reference contour, are counted in the fitting procedure for the STC, defined in ASTM E413.

In the table:

Values marked "c" indicate that the measured background level was between 5 dB and 10 dB below the combined receiving room level and background level. The reported values have been corrected according to the procedure outlined in ASTM E90-04.

Values marked "*" indicate that the measured background level was less than 5 dB below the combined receiving room level and background level. The reported values provide an estimate of the lower limit of airborne sound transmission loss.

Note: At most frequencies, the measured sound transmission loss for this specimen is above the threshold for limiting transmission loss established for flanking (structure-borne) transmission via facility surfaces. Hence the reported values for bands above 200 Hz provide an estimate of the lower limit of airborne sound transmission loss for the specimen. However, this does not affect the bands controlling the STC rating.

The results reported above apply only to the specific sample submitted for measurement. No responsibility is assumed for performance of any other specimen.

**APPENDIX:
Airborne Sound Transmission
Wall Facility**

National Research Council Canada
Institute for Research in Construction
Acoustics Laboratory
1200 Montreal Road, Ottawa, Ontario K1A 0R6
Tel: 613-993-2305 Fax: 613-954-1495

Facility and Equipment: The acoustics test facility comprises two reverberation rooms (referred to in this report as the small and large rooms) with a moveable test frame between the two rooms. In each room, a calibrated Bruel & Kjaer type 4166 condenser microphone with preamp is moved under computer control to nine positions, and measurements are made in both rooms using a real time analyzer controlled by a desktop PC-type computer. Each room has four loudspeakers driven by separate amplifiers and noise sources controlled by the computer. To increase the randomness of the sound field, there are also fixed diffusing panels in each room.

Test Procedure: Airborne sound transmission measurements were conducted in accordance with the requirements of ASTM E90-04, "Standard Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions". Airborne sound transmission loss tests were performed in the forward (receiving room is the large room) and reverse (receiving room is the small room) directions. Results presented in this report are the average of the tests in these two directions. In each case, sound transmission loss values were calculated from the average sound pressure levels of both the source and receiving rooms and the average reverberation times of the receiving room. One-third octave band sound pressure levels were measured for 32 seconds at nine microphone positions in each room and then averaged to get the average sound pressure level in each room. Five sound decays were averaged to get the reverberation time at each microphone position in the receiving room; these times were averaged to get the average reverberation times for the room. Information on the flanking limit of the facility and reference specimen test results are available on request.

Significance of Test Results: ASTM E90-04 requires measurements in 1/3-octave bands in the frequency range 100 Hz to 5000 Hz. Within those ranges, reproducibility has been assessed by inter-laboratory round robin studies. The standards recommend making measurements and reporting results over a larger frequency range, and this report presents such results, which may be useful for expert evaluation of the specimen performance. The precision of results outside the 100 to 5000 Hz range has not been established, but is expected to depend on laboratory-specific factors.

Sound Transmission Class (STC): was determined in accordance with ASTM E413-04, "Classification for Rating Sound Insulation". The Sound Transmission Class (STC) is a single-figure rating scheme intended to rate the acoustical performance of a partition element separating offices or dwellings. The higher the value of the rating, the better the performance. The rating is intended to correlate with subjective impressions of the sound insulation provided against the sounds of speech, radio, television, music, and similar sources of noise characteristic of offices and dwellings. The STC is of limited use in applications involving noise spectra that differ markedly from those referred to above (for example, heavy machinery, power transformers, aircraft noise, motor vehicle noise). Generally, in such applications it is preferable to consider the source levels and insulation requirements for each frequency band.

Confidence Limits: Acoustical measurement in rooms is a sampling process and as such has associated with it a degree of uncertainty. By using enough microphone and loudspeaker positions, the uncertainty can be reduced and upper and lower limits assigned to the probable error in the measurement. These limits are called 95% confidence limits. They are calculated for each test according to the procedures in ASTM E90-04 and must be less than upper limits given in the standards. These confidence limits do not relate directly to the variation expected when a nominally identical specimen is built, installed and tested (repeatability). Nor do they relate directly to the differences expected when nominally identical specimens are tested in different laboratories (reproducibility).

In Situ Performance: Ratings obtained by this standard method tend to represent an upper limit to what might be measured in a field test, due to structure-borne transmission ("flanking") and construction deficiencies in actual buildings.